Constraint-Induced Aphasia Therapy: Cueing Study

An Honors Thesis (HONR 499)

by

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Abstract

Constraint-Induced Aphasia Therapy (CIAT) is a program designed to treat speech in post-stroke clients incorporating the three principles of intensity, constraint, and shaping. This study focuses specifically on shaping and how cueing strategies affect the client's individual responses and overall success. George and his clinician were assessed for types of cues used, the power level of the cues used, and the overall success of those cues. Ultimately, the study concluded that the power level does not determine the success of the cue, but once a cue is charted for success, the power level below that cue should be used first. Clinicians need to keep in mind that using this strategy will ultimately strengthen neural pathways in the client.

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Constraint-Induced Aphasia Therapy: Cueing Study

Aphasia is an acquired language disorder from brain injury that can disrupt various aspects of communication (American Speech and Hearing Association, 2016). The most common cause of aphasia is a stroke, cerebral vascular accident, where a blood clot, hemorrhage, or a constriction of blood vessels damages areas of the brain that control language and communication (LaPointe, 2004). Therefore, post-stroke aphasia affects around 795,000 Americans each year, meaning a new or recurrent stroke occurs every 40 seconds in the United States ("Impact of stroke: stroke statistics," 2015). The National Aphasia Association has predicted that by the year 2020, the "yearly number of aphasia cases will double to 180,000" (National Aphasia Association, 2016) where the disorder is already affecting one million Americans.

The symptoms of aphasia are slightly different depending on the area and severity of the brain affected. The four modalities of communication that can be impaired include auditory comprehension, reading comprehension, written expression, and verbal expressions, which give a post-stroke client a unique linguistic profile. However, patterns in individuals' linguistic profiles do exist and are classified as differing types of aphasia: global, Broca's, mixed non-fluent, Wernicke's, and anomic (National Aphasia Association, 2016). Since, aphasia is a broad condition with various sub-types effecting all modalities of communication with differing severity, "treatment for the individual patient is determined by the kinds of impairment which are present, as well as the degree of existing impairment" (Schuell, Carroll, & Stansell, 2013). Therefore, many different treatment approaches have emerged with the end goal of restoring the language and communication abilities for people with aphasia.

Traditional Aphasia Treatment

Specific rehabilitation programs have been developed by speech-language pathologists to treat aphasia such as, stimulation-facilitation treatment, Combined Aphasia and Apraxia of Speech Treatment (CAAST) and Constraint-Induced Aphasia Therapy (CIAT). Some argue that stimulation-facilitation treatment lays the foundation for aphasia therapy. It consists primarily of auditory stimulation as it is "shown that all aphasic patients are impaired in the retention and recall of sound patterns" (Schuell, Carroll, & Stansell, 2013). As the client works on auditory stimulation, vocabulary usage will increase and with additional work so will the client's speech. Visual stimulation such as that found in reading and writing is also often incorporated into this type of treatment. In a CAAST program, apraxia, a motor speech disorder in which individuals have difficulty creating the motor movement plan to correctly use their articulators for speech, is a focus as well as aphasia, which is the difficulty to understand or produce speech. Often times Aphasia and Apraxia are confused because they both can result in a "loss for words;" therefore, CAAST "targets language and speech production simultaneously, with treatment techniques derived from Response Elaboration Training (RET) and Sound Production Treatment (SPT)" (Wambaugh et al., 2014, p. 2). Dr. Wambaugh's study on the CAAST treatment tracked an "increased production of correct information units in trained and untrained picture sets for all participants" (2014, p. 2). Lastly, Constraint-Induced Aphasia Therapy (CIAT) is an intense group treatment program that was established on principles of neuroplasticity.

Constraint-Induced Aphasia Therapy

Constraint-Induced Aphasia Therapy adapted three principles from constraint-induced movement therapy (CIMT) to create a treatment program that focuses on post-stroke communication impairments. Constraint-Induced movement therapy was used to treat post-

stroke motor impairments where the client trained the affected limb for several weeks and hours in a row (massed practice or intensity principle) with relevant everyday tasks (behaviorally relevant setting). Additionally, these movements were then slowly increased in difficulty (shaping principle) as the treatment was successful. Evidence and data show improvements in "upper and lower extremity impairments in chronic stroke survivors" (Meinzer, Rodriguez, & Rothi, 2012, p. 7).

The three principles created were intensity, constraint, and shaping. The basic set-up of the program includes a group of at least three clients and two-three clinicians to meet for ten days, three hours each day, to work on using only verbal speech in a language game with the help of cues from their clinician. Generally, "pairs of cards depict object drawings, written words or drawing/photographs of more complex everyday life scenarios are distributed among the players in a way that none of the players has two identical cards" (Meinzer, Rodriguez, & Rothi, 2012, p. 3). The clients then use a general request, response, and reply system (only with verbal speech) to exchange cards amongst themselves. The clients are forced to use spoken communication (constraint) and "the shaping of language functions is accomplished by introducing increasingly complex materials across training sessions" (Meinzer, Rodriguez, & Rothi, 2012, p. 3). Similar to the CIMT program, CIAT clients meet for several hours a day for several weeks, comprising the intensity of the program. Thus far, CIAT has shown increase in language functionality in chronic aphasic clients. Meinzer et. al. (2007) have reported that "patients with more severe aphasia benefited the most from the two-week intensive CI training, in particular with regard to measures of expressive functions" (p. 5). The repetition of the impaired verbal communication in the short amount of time, allows for strengthening of neural connections, and therefore, improvements are made in the client's speech. Therefore, the

constraint of using the impaired verbal communication and the intensity of the program structure has been documented for the program's success. However, because cueing is usually specific to the client and their needs, not much research has been completed on this principle.

In order to investigate shaping, it was defined as cues used to "stimulate the connections between phonologic, semantic, and concept representation knowledge to facilitate word retrieval and production" (Griffith, et. al, 2014, p. 7-8). The concept of shaping originated from operant conditioning and uses reinforcement to get participants to use correct utterances. In the CIAT program, the clinician's goal is for the client with aphasia to use increasingly difficult verbal language. The clinician will approach this with a syntactical hierarchy system that starts with singe word utterances, then phrases, simple sentences, and complex sentences. For example, in the single word utterance level, when a CIAT participant wants a card from another player, they would use words such as the person's name and the name of the wanted card. Since a stroke can affect different parts of speech production, the client may have already mastered the level of single words (i.e., around 80% accuracy). The next level of syntactical hierarchies is simple sentences, such as "The apple is green." Eventually, the CIAT participant wants to reach the level of using complex sentences, such as "The green apple sits on the desk." During CIAT, the clinician will then use shaping-cues to encourage their client to use verbal language slightly above their current ability. In most cases, the language pre-stroke is already existent, the clinician is now using shaping-cues to gradually rebuild neural connections and restore verbal language to be close to the pre-stroke level.

In addition to using syntactical hierarchies when giving cues, the power of the cue also has an effect on the response. Clinicians are taught to use a system of shaping-cues that have been coded for their type and corresponding level of power. For example, a clinician might

request for attention, give a reminder, or use a constraint cue. Each of these shaping-cues is a level one power because they serve mostly as a reminder or are a simple request. The levels then range up to a power of six where the clinician is actually asking the client to repeat his/her verbal model. Just as the client moves from words to simple sentences and then eventually on to complex sentences, the clinician should also move in sequential order with the cueing levels, either least-to-most or most-to-least powerful based on the client's response.

Purpose of the Study

Due to the dearth of knowledge on the role of the shaping principle within CIAT, this study focused on shaping and investigated the types of shaping-cues provided to people with aphasia during a CIAT program. Specifically, the shaping-cues provided to one person with aphasia, George, over the course of a ten-day CIAT program were analyzed. The clinician provided shaping-cues were examined for shifts in the types of cueing and the power of the cues given. Three research questions were investigated:

1) Did the types of cues given change from Day 2 to Day 10 of the CIAT program?

2) Did George require less powerful cues on Day 10 than Day 2 of the CIAT program?

3) Were the cues given to George more successful on Day 10 than Day 2 of the CIAT program?

Method

Research Design

This investigation utilized a case study design in which the shaping-cues that were provided to one participant during sessions occurring on day two and day ten of a 10-day CIAT program were compared. This case study is part of a larger investigation, 'fMRI of Language Recovery Following Stroke in Adults' (NIH R01 NS048281) randomized control trial

(NCT00843427), under primary investigator Jerzy P. Szaflarski, M.D., Ph.D, and was approved by The University of Cincinnati Institutional Review Board for human research.

Intervention

In the study design, three clients with aphasia and a clinician for each client were in one group. The group met for ten days for three hours each day where each day consisted or four sessions that lasted for 45 minutes for a total of 30 hours. The clients played a card game where they would use only verbal speech to request cards from the other clients to make pairs with the cards in front of them. Each section would include a different card set, which would focus on various parts of speech, such as nouns or verbs.

Linguistic Testing

George was given the following standardized tests pre and post- treatment: Boston Naming Test (BNT) (Goodglass, Kaplan, & Barresi, 2000), Boston Diagnostic Aphasia Exam-Complex Ideational Material (BDAE-CIM) (Goodglass, Kaplan, & Barresi, 2000), Semantic Fluency Test, Controlled Oral Word Association Test (COWAT) (Benton, Hamsher, Rey, & Sivan, 1994), and Peabody Picture Vocabulary Test (PPVT) (Dunn & Dunn, 1997).

Shaping Cues and Analysis

The specific cues investigated included: request attention, reminder, constraint cue, semantic function, semantic reminder, semantic phrase completion, phonetic with visual model, phonetic first phoneme(s), articulatory placement, choice of two words, and word imitation. See the appendix for further description and examples of each cue type.

Videos collected during the original Day 2 and Day 10 from the 2011 study were transcribe and the transcripts were verified by the research team. To explore the research questions, a sample of the first seven turns from sessions 2 and 3 occurring on day 2 and day 10

were examined. A turn started with George calling the other players name or when George first attempted to describe his card. George's turn ended when the next player initiated a turn in the same manner. Only the cues given during George's turn were used in the study. To help answer the second research question, each cue has been previously assigned a power level based on how direct the cue is (Appendix). A high level of power, such as 6, means the cue gives a large amount of information needed to access the word or phrase in question. For instance, if the participant is trying to say the word "blue," the clinician might use a word imitation cue (highest power of 6) by simply having the client repeat the word "blue" back to him/her. A low power level, such as 1, means that the cue given is simply to direct the participant's attention or remind them of the task at hand so the participant can answer the given question or create a logical statement. For example, a reminder cue has a power level of 1 because the clinician might say something such as "remember, you want to say the name of the person you are talking to first." Lastly, to help answer research question three, a cue was coded as effective or successful when the response given did not require additional prompts or cues. Additionally, the target word/phrase/sentence was generated or the communication partner answered the question. A cue was coded as ineffective or unsuccessful when an additional prompt or cue was required to generate the target word or response or when completely abandoned. The data were found to be 96% reliable for coding of cues and 99% reliable for success.

Results

George

George, a 67 year old Caucasian male, was part of a CIAT program in 2011 where he was 39 months post onset of stroke that caused Broca's Aphasia and Moderate-Severe Apraxia. Broca's Aphasia is referred to as "non-fluent aphasia" because it affects the person's ability

access vocabulary, form sounds, and overall speech output is reduced (National Aphasia Association, 2016). Apraxia then involves the inability to correctly move the articulators needed to produce speech. Overall, both Broca's Aphasia and the Moderate-Severe Apraxia caused George to have trouble retrieving and producing speech even though he could understand language. Before the incident, George was an avid runner and had earned a Bachelor's degree to be a salesman. He had an outgoing and extroverted personality and enjoyed attending Big 10 football games.

Testing. George received the following scores on the pre- and post-standardized linguistic tests. On the *Boston Naming Test* (Goodglass, Kaplan, & Barresi, 2000), George received a pre-treatment score of 9 and a post-treatment score of 9. On the *Boston Diagnostic Aphasia Exam- Complex Ideational Material* (Goodglass, Kaplan, & Barresi, 2000), George received a pre-treatment score of 10 and a post-treatment score of 10. On the Semantic Fluency Test, George received a pre-treatment score of 10 and a post-treatment score of 13. On the *Controlled Oral Word Association Test* (Benton, Hamsher, Rey, & Sivan, 1994), George received a pre-treatment score of 4 and a post-treatment score of 9. Lastly, on the *Peabody Picture Vocabulary Test* (Dunn & Dunn, 1997), George received a pre-treatment score of 118 and a post-treatment score of 104. See the following table for George's assessment data.

Table 1

George's Assessment Data

BNT[a]		BDAE-CIM[b]		Semantic Fluency Test		COWAT[c]		PPVT[d]	
pre	post	pre	post	pre	post	pre	post	pre	post
9	9	10	10	10	13	4	9	118	104

Note: [a]*Boston Naming Test* (BNT) possible score 60, [b]*Boston Dianostic Aphasia Exam- Complex Ideational Material (BDAE- CIM)* possible score 12, [c]*Controlled Oral Word Association Test (COWAT)* [d]*Peabody Picture Vocabulary Test (PPVT) standard scores*

Cueing.

1) Did the types of cues given change from Day 2 to Day 10?

The phonetic first phoneme cue was implemented 12 times on Day 2 and 14 times on Day 10, word imitation was used 11 times on Day 2 and 8 times on Day 10, choice of two words was used 11 times on Day 2 and 6 times on Day 10, reminders were used 8 times on Day 2 and 9 times on Day 10, semantic reminder was used 6 times on Day 2 and 6 times on Day 10, semantic function was used 4 times on Day 2 and 0 times on Day 10, phonetic with visual model was used 4 times on Day 2 and 10 times on Day 10, request attention was used 2 times on Day 2 and 0 times on Day 10, semantic phrase completion was used 1 time on Day 2 and 2 times on Day 10, and articulatory placement was used 1 time on Day 2 0 times on Day 10. In summation, these 10 cue types in 7 turns accounted for 60 total cues on Day 2 and 55 total cues on Day 10. Refer to table 2 for cueing data.

Table 2

Types of Cues Given: Day 2 vs Day 10

Cue	Day 2 Frequency	Day 10 Frequency
Phonetic first phoneme(s) (PCFP)	12	14
Word imitation (WI)	11	10
Choice of two words (CTW)	11	6
Reminder (R)	8	9
Semantic Reminder (SR)	6	6
Semantic Function (SF)	4	0
Phonetic with visual model (PCV)	4	10
Request Attention (RA)	2	0
Semantic phrase completion (SPC)	1	2
Articulatory placement (AP)	1	0
Total	60	57

Note: The first 7 turns were evaluated for types of cues on both Day 2 and Day 10
Cue Codes: Phonetic first phoneme (PCFP), Word imitation (WI),
Choice of two words (CTW), Reminder (R) , Semantic Reminder (SR),
Semantic function (SF), Phonetic with visual model (PCV),
Request attention (RA), Semantic phrase completion (SPC), and
Articulatory Placement (AP)

2) Did George require less powerful cues on Day 10 than Day 2?

The power of 6, from word initiation, was used 11 times (18%) on Day 2 and 8 times (18%) on Day 10. Power 5, from choice of two words, was used 11 times (18%) on Day 2 and 6 times (11%) on Day 10. Power 4, from phonetic first phoneme and articulatory placement, was used 13 times (22%) on Day 2 and 14 times (25%) on Day 10. Power 3, from semantic phrase completion and phonetic with visual model, was used 5 times (8%) on Day 2 and 12 times (21%) on Day 10. Power 2, from semantic function and semantic reminder, was used 10 times (17%) on Day 2 and 6 times (11%) on Day 10. Power 1, from reminder and request attention, was used 10 times (17%) on Day 2 and 9 times (16%) on Day 10. See table 3 for specific data.

Table 3

Frequency of Cue Powers: Day 2 vs Day 10

Power	Cues	Day 2 Frequency	Percentage	Day 10 Frequency	Percentage
6	WI	11	18%	10	18%
5	CTW	11	18%	6	11%
4	PCFP, AP	13	22%	14	25%
3	SPC, PCV	5	8%	12	21%
2	SF, SR	10	17%	6	11%
1	R, RA	10	17%	9	16%
		60		57	

Cue Codes: Phonetic first phoneme (PCFP), Word imitation (WI), Choice of two words (CTW), Reminder (R) , Semantic Reminder (SR), Semantic function (SF), Phonetic with visual model (PCV), Request attention (RA), Semantic phrase completion (SPC), and Articulatory Placement (AP)

3) Were the cues given to George more successful on Day 10 than Day 2?

Out of the 60 cues from the first seven turns on Day 2, 29 (48%) were coded for success and 31(52%) were considered unsuccessful. Out of the 57 cues identified during the first seven

turns on Day 10, 28 (49%) were considered successful and 29 (51%) were coded as unsuccessful. See table 4 to see the frequency of success for both days.

Table 4

Success in Day 2 vs. Day 10

	Frequency in Day 2	Percentage	Frequency in Day 10	Percentage
Successful Cues	29	48%	28	49%
Unsuccessful Cues	31	52%	29	51%
Totals	60		57	

Discussion

While little changes were noted in George's cueing data, he did improve his communication skills through the CIAT training. George required less cues on Day 10, but those cues were not necessarily less powerful cues. Overall, the cues given on Day 2 were just as successful as those given on Day 10.

Did the types of cues given change from Day 2 to Day 10?

Upon visual examination of the data, George required less total cues from Day 2 to Day 10. It was clear from watching George's Day 10 session videos that he had become more confident and was even able to take a full turn (his 5th turn) without any assistance from his clinician at all. When assistance was needed, less cues were required to reach the desired response on Day 10. For instance, George only needed two prompts to complete his second turn. On day 2, around 8 prompts were averaged per turn and around 5 prompts were averaged on Day 10. Which also brings up an important point that one cue (or prompt) might encompass several cue types. For instance, the cue "bl blow" is coded with three cue types: phonetic with visual model, phonetic first phoneme, and also word imitation. Therefore, when analyzing the data on cue types, keep in mind that one cue type was likely paired with another cue type to create one

full prompt. Either way the data is presented (i.e. when all cue types were counted: 60 cues on Day 2 vs. 57 cues on Day 10 OR when only the clinician's prompt with several cue types included was counted: 49 prompts on Day 2 vs. 42 prompts on Day 10), it shows that George required few prompts to produce a desired response.

To further show how progress was made, the data should be reviewed for an important outlier. On Day 10, George only needed 32 total cues before his 7th turn which required 24 total cues in 13 prompts. Therefore, even though George demonstrated immense improvement in terms of how much help was required, his last turn greatly affected the data. Fatigue may be to blame because of the intensity of the program. As George struggled to find the words to describe his cards, he definitely showed signs of frustration (such as increased sighing) which are attributed to fatigue. However, fatigue cannot be considered the sole reason behind the need for many cues.

George had a different clinician assisting his speech on Day 2 than he did on Day 10. Therefore, when looking at the cues used on both of those days, the changes in cue types might have been the change in preference between the two clinicians despite receiving the same training. For instance, the use of choice of two word cues dramatically decreased from 11 times on Day 2 to only 6 times on Day 10. Additionally, phonetic first phoneme cues (i.e., 12 Day 2; 14 Day 10) and phonetic with visual model cues (i.e., 4 Day 2; 10 Day 10) both increased. Therefore, the change could be attributed to the clinician preference as well as gains George made until success of the cues is examined.

Did George require less powerful cues on Day 10 than Day 2?

Looking at the "Frequency of Cue Powers: Day 2 vs. Day 10" chart, data show that on Day 2, George received a large amount of the most powerful cues, but also a large amount of low

powered cues. On Day 10, George received less low powered cues but more medium powered cues. Therefore, no clear pattern emerged.

A few factors can help explain this finding. First of all, as discussed before, the use of two different clinicians might have skewed the data. Secondly, the biggest factor of the increase of 3-4 powered cues was the use of phonetic first phoneme cues and phonetic with visual model cues instead of choice of two word cues. Analysis from "Types of Cues Given: Day 2 vs. Day 10" shows that on Day 2, choice of two word cues were used 11 times, but dropped to 6 times on Day 10. Additionally, phonetic with visual model cues were used 4 times on Day 2 and increased to 10 times on Day 10, same as phonetic first phoneme cues increased from 12 to 14 times. Choice of two word cues have a power of 5; whereas, phonetic first phoneme cues have a power of 4 and phonetic with visual model cues have a power of 3. Therefore, it supports the trend that less powerful cues would be needed for success as the George advances in the CIAT program. However, additional investigation is needed.

Overall, the data show that the power of the cue given did not decrease as the program progressed, like hypothesized. However, the power of the cue should not be dismissed as a valuable tool in determining how to shape a client's response. Rather, both the success of a cue and its power should be considered in combination.

Were the cues given to George more successful on Day 10 than Day 2?

Not much literature has been produced on the topic of shaping because of the notion that each person is unique in their linguistic profile, and therefore, needs to be shaped differently. While this statement is true, many factors affect the success of the cue given, and furthermore, the treatment that is being administered. Ultimately, the success of the cues given will correlate with each client's overall progress.

Upon visual analysis of the "Success in Day 2 vs. Day 10" chart, there was only a very slight increase, if any, in the overall amount of successful cues, moving from 48% successful on Day 2, to 49% successful on Day 10. Therefore, to gain valuable information, a deeper analysis is needed.

Again, referring back to the drastic change in the use of choice of two words cues versus the use of phonetic first phoneme cues and phonetic with visual model, and analyzing the use for its success. On day 2, 8 out of the 11 choice of two word cues were coded as unsuccessful (only 28% successful). 6 out of the 12 of phonetic first phoneme cues were unsuccessful (50% successful) and 1 out of the 4 phonetic with visual model cues was unsuccessful (75% successful). Therefore, the data clearly showed that even though choice of two word cues are a higher power than phonetic first phoneme cues and phonetic with visual model cues, and in turn are thought to be more successful, George did not positively respond to that cue type. This brings up two important points about success. First of all, success is not always correlated with the power of the cue given. Just because a cue has a high power, does not mean the neural pathway has been fully established to connect the cue given and the correct response needed. Therefore, a clinician should be aware of the client's success rates with a certain cue and use lower powered cues to help build the neural pathways to ultimately let the client create the necessary connections themselves. Secondly, many variables affect success rates such as fatigue and familiarization with the topic.

Another factor that affects success of a certain cue involves the client's additional communication deficits besides aphasia. For example, George also has apraxia, or a disconnect between the brain and the correct motor movement to make the sound. Therefore, maybe the increased use of phonetic first phoneme cues and phonetic with visual model were successful

because George needed help forming the correct motor movement to produce the word. Additional studies need to be administered to understand if this information is true for most apraxic and aphasic clients.

Future Considerations

Further research needs to be conducted on various communication deficits, such as apraxia, and which cues foster both success in the turn and success in CIAT. Further studies can additionally investigate:

1) How do cueing hierarchies (using cues from most to least or least to most power) affect the success of the client's responses and overall improvement?
2) When a client does not know they have apraxia, or another communication disorder, is there shifts in cues that would help indicate the problem?
3) How much does fatigue affect success?
4) Does the use of only one clinician through the whole program affect the data?
5) Do cues examined for longer than 10 days affect the results found in this study?

Limitations

Several limitations are inherent to this study. First, this investigation was a single case, so there were not additional data to compare the findings with. Also, George's clinician on Day 2 was a different clinician than on Day 10. It is possible that the data gathered is slightly skewed by the clinician's own preference in cue types. Such as, one clinician does not want her client to get too frustrated so she used a lot of phonetic first phoneme cues, whereas another clinician wants to see her client succeed on his own so she used phonetic first phoneme cues as a last resort.

Conclusions

The reason why clinicians give cues or shape clients is to help the client become independent communicators. With post-stroke aphasia, speech is often debilitated and therefore it is difficult for the person to communicate. Cues allow people with aphasia to self-regulate their speech. This study suggests that a clinician should chart for success as part of their progress reports- specifically for their cues. The success levels of certain cues will allow the clinician to know which cues will foster the most neural strengthening. For example, if choice of two word cues have been really successful, then the clinician should use cues that are under a power of 5 before they resort to the choice of two word cue.

This investigation contributed to the literature on the shaping aspect of CIAT. However, shaping is a basic task of a speech-language pathologist and this information can carry over to almost any type of treatment that involves cueing. Clinicians need to be more aware of the cues they are giving to clients, and not only be charting client's responses but also the success of cues.

Appendix Table One

Cues coded and corresponding level of power

Type of Shaping Cue	Definition	Example	Cognitive-Linguistic Area/s Stimulated	Level of Power
Request attention	Redirecting the person with aphasia to engage in the language task/game.	Clinician: "Listen, John asked you a question."	Attention	1
Reminder	Reviewing goals or prompting the person with aphasia to recall and use their linguistic goals.	Clinician: "Remember you are working on using the phrase 'do you have' or 'Bob, did you use a verb'?"	Memory	1
Constraint cue	Reminder not to use gestures, writing, drawing, and/or augmentative and alternative communication as a substitution for spoken language.	Clinician: "Try not to use your fingers."	Memory	1
Semantic function	Providing a description of the function of the target word.	Clinician: "This is something you sit on" for the target chair.	Attention, Semantic	2
Semantic reminder	Providing a prompt for more information.	Clinician: "What is she doing in the picture?" or "Can you pair that with a verb?"	Attention, Semantic	2
Semantic phrase completion	Providing a semantically related phrase for the participant to complete using the target word.	Clinician: " People clean their teeth with a ___" for the target toothbrush.	Attention, Semantic, Conceptual Context	3
Phonetic with visual model	Providing a visual model of the articulatory placement of the first phoneme(s).	Clinician: "Look at me it starts with [bites lip and/or points to bottom lip]" for the target /f/ for	Attention, Phonological, Articulatory motor	3

		frog without producing the phoneme		
Phonetic first phoneme(s)	Providing a visual and acoustic model of the first phoneme(s) of the target word.	Clinician: "It starts with /sp/" for the target /spoon/.	Attention, Phonological, Articulatory motor, Acoustic	4
Articulatory placement	Providing a visual, acoustic, and articulatory placement model of the first phoneme(s) of the target word.	Clinician: "Press your lips together." For the target /b/ in blue	Attention, Phonological, Articulatory motor, Acoustic	4
Choice of two words	Presenting the target word along with a semantically or phonemically similar or dissimilar word.	Clinician: "Is it a heart or a cart?" for a phonetically similar cue of the target heart. Clinician: "Is it a cookie or a pizza?" for a semantically similar cue for the target cookie.	Attention, Phonemic, Semantic, Concept, Acoustic, Lexical model	5
Word imitation	Presenting a verbal model of the target word and requesting a repetition	Clinician: "It is a bucket. Say bucket."	Attention, Phonemic, Semantic, Concept, Acoustic, Lexical model	6

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